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IS 9279 (1979): Code of safety for aluminum phosphide [CHD 8: Occupational Safety, Health and Chemical Hazards]

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IS : 9279 - 1979

Indian Standard

CODE OF SAFETY FOR ALUMINIUM PHOSPHIDE

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MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

October 1980

AMENDMENT NO. 1 DECEMBER 1981
TO
IS:9279-1979 CODE OF SAFETY FOR ALUMINIUM PHOSPHIDE

Corrigenda

(Page 3, clause 0.2, line 1) - Substitute 'in the form of tablets/pellets' *for* 'specially in the form of tablets'.

(Page 3, clause 0.3, line 1) - Substitute 'phosphide' *for* 'phosphite'.

(Page 4, clause 3.2):

a) *Line 2* - Substitute 'pellets/tablets' *for* 'small pellets or tablets'.

b) *Line* 3 - Substitute 'IS:6438-1980*' *for* 'IS:6438-1972[‡]'.

Alteration

(Page 6, clause 5.3, CAUTION) - Substitute the following for the existing matter:

'ALUMINIUM PHOSPHIDE AND ITS FUMES ARE HIGHLY TOXIC. ALWAYS OPEN THE CONTAINER IN OPEN AIR. DO NOT OPEN THE CONTAINER WITH ANY SHARP METALLIC DEVICE, AS DUE TO FRICTION, THE CONTENTS MAY CATCH FIRE. DO NOT INHALE FUMES OR DUST. WEAR PROTECTIVE CLOTHING AND RESPIRATOR DURING USE, KEEP THE MATERIAL AWAY FROM CHILDREN AND DOMESTIC ANIMALS. DESTROY EMPTY CONTAINERS. IN CASE OF SIGNS OF POISONING, TAKE THE PATIENT IN OPEN AIR AND CALL A PHYSICIAN.'

(CDC 18)

Reprography Unit, ISI, New Delhi, India

Indian Standard

CODE OF SAFETY FOR ALUMINIUM PHOSPHIDE

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(*Continued on page 2*)

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(*Continued on page* 9)

Indian Standard

CODE OF SAFETY FOR ALUMINIUM PHOSPHIDE

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 26 October 1979, after the draft finalized by the Chemical Hazards Sectional Committee had been approved by the Chemical Division Council

0.2 Aluminium phosphide formulations specially in the form of tablets are widely used to generate phosphine, a fumigant gas, for the control of various types of pests like stored product insects, field rodents, snakes, crabs, etc Therefore, detailed knowledge about its toxicity and hazards would be useful in ensuring safety in the use of this hazardous chemical.

0.3 Aluminium phosphite is included in the Schedule of Approved Insecticides under the Insecticides Act, 1968.

0.4 In the preparation of this standard, assistance has been drawn horn the following publications.

a) MONRO (HAU) FAO Agriculture Studies No. 79 Manual of Fumigation for insect Control 1969 Ed 2. Food and Agricultural Organization.

b) Toxic and Hazardous industrial chemicais safety manual. 1976, The International Technical Information Institute, Tokyo.

c) THOMSON (WT). Agricultural Chemicals, Book III — Fumigants, growth regulators, repellents and rodenticides. 1976-77. Thomson Publications, California, USA

1. SCOPE

1.1 This code describes properties of aluminium phosphide; nature of hazards associated with it; safety measures for controlling hazards; and essential information on symptoms of poisoning, first-aid, medical treatment, storage, handling, labelling and employee safety.

1.2 This code does not, however, deal with specifications for design of buildings, chemical engineering plants, methods and ingredients used in manufacture, dosages and exposure periods or directions for its use in fumigation.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 4155-1966* and IS : 4167-1966† shall apply.

3. GENERAL DESCRIPTION AND PROPERTIES OF ALUMINIUM PHOSPHIDE

3.1 Description — Aluminium phosphide is available in the form of small pellets or tablets containing aluminium phosphide and other inert ingredients (*see* IS : 6438-1972‡). The pellets/tablets release about 33 percent by mass of phosphine gas, on contact with atmospheric moisture or acids

3.2 Properties of Phosphine Gas

a) Chemical formula	PH_3
b) Boiling point	-87.4°C
c) Odour	Carbide or garlic like
d) Toxicity to mammals.	
1) Acute inhalation LC_{50} (rat)	28 ppm/5h
2) Recommended maximum exposures § believed safe for human subjects are as follows:	
—Single exposures, not more than once a week for	
7 hours	1 ppm
1 hour	25 ppm
0.1 hour	50 ppm
—Repeated exposures, 8 hours/day, 5 days/ week (Threshold Limit Value, AGGIH, 1979)	0.3 ppm or 0.4 mg/m^3
3) No chronic toxicity to man has been observed for phosphine.	
e) Explosion point, lowest	1.79 percent by volume in air.

---

*Glossary of terms relating to chemical and radiation hazards and hazardous chemicals.

†tGlossary of terms relating to air pollution.

‡Specification for aluminium phosphide tablet formulation.

§These values of TL have also been recommended by American Conference of Governmental Industrial Hygienists, 1977

4. NATURE OF HAZARDS ASSOCIATED WITH ALUMINIUM PHOSPHIDE

4.1 Fire Hazard — On contact with moisture of acids, aluminium phosphide preparations rapidly liberate phosphine gas which is flammable

NOTE — Flammability of phosphine gas appeals to be due to traces of diphosphine (P_2H_4), formation of which is controlled during manufacture by adding fire retardants

4.2 Heat Hazard — When exposed to fire, alummium phosphide emits highly toxic fumes of phosphorous oxides, which react with water or steam to produce further toxic and flammable vapours

4.3 Health Hazard — Aluminium phosphide can lead to poisoning either on inhalation of phosphine gas liberated from it or on swallowing.

4.3.1 Symptoms of poisoning as a result of inhaling liberated phosphine are as follows:

a) *Slight or mild poisoning* — Feeling of fatigue, dizziness, nausea, vomiting, buzzing in the ears, pressing sensation in the chest, intestinal pain and diarrhoea Ashen complexion is typical.

b) *Medium to severe poisoning* — Previous symptoms may be followed by dry cough, dyspnoea, intense thirst, excessive perspiration, pain in the limbs, ataxia, anuria, convulsions and rapid onset of stupor.

4.3.1.1 Signs of poisoning by inhalation include dilated pupils, haemoglobmuria, *albuminuria,* anaemia, jaundice and thrombocytopaenia.

4.3.2 In the case of swallowing, aluminium phosphide decomposes by the action of gastric at id in the stomach and severe symptoms of poisoning quickly appear, heavy vomiting is followed by unconsciousness.

5. STORAGE, HANDLING AND LABELLING

5.1 Storage

5.1.1 *In Production/Formulation Plants* — Always store aluminium phosphide preparations in plainly labelled metal drums in separate closed, dry, well-lit rooms of sufficient dimensions to avoid significant contamination with phosphine gas and far away from rooms/premises used for storing other articles, especially food articles. Keep away from moisture and flame Storage areas should have adequate suction facilities (for example, blowers, etc), so that good air circulation is maintained. All storage vessels should have safety valves so as to release pressure in case of excess phosphine generation.

5.1.2 *Storage During Transport* — Always store aluminium phosphide preparations in airtight (leakproof) containers [*see* IS . 8190 (Part IV)*].

5.2 Handling —Always observe the following safety measures while handling aluminium phosphide preparations

5.2.1 *In Manufacturing Plant*

a) Wear gloves, gas mask with fresh an supply apparatus

b) Do not inhale fumes or dust

c) Smoking. drinking of eating in the plant should be strictly prohibited

d) Odour of phosphine should never be ??? upon as an indication of its poisonous concentration. It would be advisable to monitor it from time to time

e) Employes in plant should wash bathe on leaving work and they should be educated about hazards of aluminium phosphide phosphine

5.2.2 *In Fumigation Hork*

a) Wear rubber gloves while disposing tablets by hand.

b) Respirators need not be worn when tablets are being dispersed under conditions where operators breathe concentrations of phosphine gas below threshold limit value of 0 3 ppm.

c) Warning notices should be posted near the fumigation areas to prevent exposure of employees public to the gas

d) All copper containing equipment and parts in the godown or other structures should be protected before fumigation starts, by covering and pasting them with wax paper

e) Novel fumigate any commodity except under expert supervision in air tight leak-proof covers, bins and other storage structures.

f) Always thoroughly aerate fumigated area for prescribed time interval, before processing fumigated commodity

5.3 Labelling - The following information shall be incorporated on the labels along with other instructions'

CAUTION

ALUMINIUM PHOSPHIDE FUMES HIGHLY TOXIC. OPEN THE CONTAINER IN OPEN AIR. AVOID USE OF METALLIC DEVICE FOR OPENING AS IT MAY CATCH FIRE DESTROY EMPTY CONTAINERS. KEEP AWAY FROM WATER.

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*Requirements for packaging of pesticides Part IV Fumigant (*under preparation*)

6. FIRST-AID AND MEDICAL MANAGEMENT

6.1 First Aid

6.1.1 If symptoms of poisoning due to inhaling appear, the affected person should immediately be taken into the open for fresh air, laid down in a comfortable position and kept warm (use blankets if necessary).

6.1.2 If symptoms of poisoning due to swallowing appear induce vomiting by giving a tablespoonful of salt in a glass of water and remove the victim to hospital at once.

6.2 Medical Treatment

6.2.1 If symptoms of poisoning due to inhaling appear

a) Administer oxygen promptly and adequately. Bronchodilators and decongestants may be given Maintain alkaline urine, by slowly giving 50 to 100 ml of 7.5 percent sodium bicarbonate (m/v) I V , or by giving fairly largc closes of sodium bicarbonate orally through a Byles tube.

b) *In case of initial toxic pulmonary oedema* — maximum doses of steroids, that is, 500-1 000 mg of prednisolone, can be given on the first day. Hypertonic solution of glucose may be injected intravenously.

c) *In case of manifest pulmonary oedema* -- Venesection should be performed under vein pressure control. Heart glycosides may be given, (In case of haemo concentration venesection may result in shock)

d) *In case of progressive oedema of the lungs* — Immediate intubation with constant removal of oedema fluid and oxygen over pressure respiration, as well as any measures required for shock treatment should be undertaken. Check electrolytes for treatment of oxygen blocking (enzyme blocking) by blood exchange transfusion.

e) In case of kidney failure extracorporeal haemodialysis is necessary.

6.2.2 If symptoms of poisoning due to swallowing appear, induce vomiting giving 0 2 percent copper sulphate solution which acts as an emetic and also produces insoluble cupric phosphide which can be at once removed by gastric lavage with 1 : 5 000 potassium permanganate solution. Give 25 ml of milk of magnesia or beaten whites of 2 or 3 eggs. Avoid fats and oils

7. EMPLOYEE SAFETY

7.1 Employee Education — Safety generally depends, to a great extent, upon the effectiveness of employees education, proper safety instructions, intelligent supervision and use of safety equipment. Training classes should be conducted to maintain a high degree of safety in handling procedures. Workers should be thoroughly informed of the hazards that may result from improper handling of aluminium phosphide. Each employee should know what to do in an emergency and should be fully informed as to first-aid measures

(*Continued from page* 2)

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INDIAN STANDARDS
ON
CHEMICAL AND ALLIED HAZARDS

IS:	
1260 (Part I)-1973	Pictorial markings for handling and labelling of goods: Part I Dangerous goods
1446-1959	Classification of dangerous goods
4155-1966	Glossary of terms relating to chemical and radiation hazards
4209-1966	Code of safety for chemical laboratories
4262-1967	Code of safety for sulphuric acid
4263-1967	Code of safety for chlorine
4264-1967	Code of safety for caustic soda
4312-1967	Code of safety for lead and us compounds
4544-1968	Code of safety for ammonia
4560-1968	Code of safety for nitric acid
4607-1968	Classification of hazardous chemicals and chemical products
4644-1966	Code of safety for benzene toluene and xylene
4906-1968	Code of safety for radiochemical laboratory
5184-1969	Code of safety for hydrofluoric acid
5208-1969	Code of safety for acetic acid
5302-1969	Code of safety for acetic anhydride
5311-1969	Code of safety for carbon tetrachloride
5685-1970	Code of safety for carbon disulphite (Carbon bisulphide
5931-1970	Code of safety for handling cryogenic liquids
6156-1971	Code of safety for chlorosulphomic acid
6164-1971	Code of safety for hydrochloric acid
6269-1971	Code of safety for ethylene oxide
6270-1971	Code of safety for phenol
6818-1973	Code of safety for phosphoric acid
6819-1973	Code of safety for calcium carbide
6953-1973	Code of safety for bromine
6954-1973	Code of safety for caustic potash
7415-1974	Code of safety for aniline
7420-1974	Code of safety for phthalic anhydride
7444-1974	Code of safety for methanol
7445-1974	Code of safety for acetone
7812-1975	Code of safety for mercury
8185-1976	Code of safety for phosgene
8388-1977	Code of safety for nitrobenzene
9052-1978	Code of safely for aluminium chloride, anhydrous
9053-1978	Code of safety for *m*-dinitrobenzene

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	1 N = 1 kg.m/s^3
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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